

ECOLOGY AND TAXONOMY OF THE FIELD MICE IN THE ARAVALLI RANGES¹

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Small mammals were trapped every month during 1993 from various habitats at different altitudes of the Abu hill situated on the southern region of the Aravalli ranges. In 0.25 million trap hours, along other mammals, 61 mice specimens were collected. Detailed analysis of the vegetation and soil types, reveal that *Mus platythrix* and *Mus saxicola sadhu* prefer habitats with soil base whereas *Mus phillipsi* is a rock dwelling species. The canopy cover had no apparent relationship with them but grass patches even on higher altitudes were preferred. *Mus terricolor*, being reported for the first time from Rajasthan State, was found in flat scrublands in the foothills. *Mus platythrix* was relatively abundant at an higher altitude, 1500-1600 m whereas *M.s. sadhu* was more prolific in the foothills and *Mus phillipsi* occurred at all the elevations.

The prevalence of pregnancy in all *Mus* species was found to be rather low. Pregnant *M. s. sadhu* were found from April to September, litter size being 5.4, range 2-9. On the basis of cranial characters, a key to determine *Mus* species is presented.

INTRODUCTION

The Aravalli ranges diagonally bisect the State of Rajasthan into a western arid region and the eastern semi-arid zone. The western desert, the Thar, is continued into a chain of deserts constituting the great Saharo-Tharian plain. The Aravalli range is a geographical barrier for the xeric fauna for spreading towards the east, into the Oriental region. It is, however, a pathway for the Deccanian elements to invade the desert through its western foothills. In spite of its interesting zoo-geographical location and archaic rock formation, very little work has been carried out on its faunal diversity. We trapped small mammals all the year round at various altitudes and in different habitats. The results of our study on the ecology and taxonomy of mice are presented in this communication.

THE STUDY AREA AND METHODS

The Abu hill is situated on the southern region of the Aravalli ranges in the Sirohi district of

Rajasthan. It presents a variety of habitats at various altitudes with a clear stratification of vegetation types. On the basis of evaluation of altitude, terrain, soil and vegetation we identified five habitats for this study. During 1993, small mammals were collected every month from these habitats by fixing two trap lines of 30 traps in every habitat. Snap traps were spaced at a distance of 10 metres in each trap line. In all more than 300 snap traps were laid every month and were run for 72 hours. The trapped specimens were measured, numbered by toe-clipping method and preserved in formaldehyde. Skulls were prepared and measured. Specimens were identified following keys provided by Wroughton (1918), Ellerman (1947, 1961) and Marshall (1977).

RESULTS

In about 2,59,200 trap hours a large number of small mammals were collected out of which 61 specimens of mice have been assigned to four species.

Fawn coloured spiny mouse *Mus phillipsi* Wroughton, 1912

This spiny mouse occurs in all the habitats of the Abu hills inclusive of the runnels. Except for one specimen which was collected from low scrubland near rocky outcrops, all others (95%) were

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collected from rocky habitat. This mouse appears to be typically a rock dweller. In various districts of the Thar desert, it was reported from hills only and associated with *Euphorbia caducifolia* (Prakash *et al.* 1971). In the Aravalli hills it also occurs in runnels (16%) which have a poor vegetation cover and in rocky regions with sparse vegetation (68 %) as compared to localities with dense vegetation (10 %; Table 1). *Mus phillipsi* was more common in regions with *Euphorbia neriifolia* shrubs. It was uniformly distributed at all the altitudes (Table 1).

TABLE 1
HABITAT PREFERENCE OF FIELD MICE IN THE ARAVALLI RANGES

	<i>Mus phillipsi</i>	<i>Mus platythrix</i>	<i>Mus saxicola</i>	<i>Mus terricolor</i>
Stonewall	—	30.8	7.4	—
Runnel	15.8	—	—	—
Scrubland				
Foothill	5.3	15.4	18.5	100
High Elevation	—	23.1	11.1	—
Rocky with dense Vegetation	10.5	15.4	22.2	—
Rocky with sparse Vegetation	68.4	15.4	40.7	—

Note: The values are denoted in percentage.

Mus phillipsi from the Aravallis is slightly larger in size as compared to those examined by Marshall (1977).

	Aravalli Collection		Marshall, 1977
	Male	Female	
Head & Body	76.0±7.04	71.4±8.6	73.5±7.4
Tail	60±5.7	56.3±7.7	58.5±4.0
Hindfoot	13.9±1.0	14.2±1.5	15.0±0.9
Body weight	14.83±4.71	11.0±4.0	12.3±2.9
ON*	21.7±1.0	21.4±1.2	22.37±0.47
PF**	5.25±0.5	4.9±0.45	5.0±0.26
Upper Molar length	3.7±0.41	3.6±0.24	3.72±0.22

* Occipitonasal length. ** Length of palatine foramina.
All measurements are in millimetres and grams.

Brown spiny mouse *Mus platythrix* Bennett, 1832

The largest of the four mice possessing fur with distinct spines scattered all over the dorsal side. It was trapped from various habitats (Table 1) and altitudes (Table 2) and occupied flat areas over the hills and loosely piled stone walls around the crop fields. In the rocky habitat it was found in places where soil deposits were present in which their burrows were located.

The near vicinity of its burrows was covered by ground hugging vegetation like *Cyperus rotundus*, *Cynodon dactylon*, *Cymbopogon martinii*, etc. Spiny mice were collected in equal number from rocks with and without dense tree vegetation (Table 1), it appears that its distribution is not largely affected by canopy cover. In the scrublands, it was more abundantly found at higher altitudes, 1500 metres as compared to the foothills. 61 % *M. platythrix* were collected at 1500 m altitude (Table 2).

The Aravalli specimens are smaller in size as compared to those examined by Marshall (1977) but were heavier in body weight.

	Aravalli Collection		Marshall, 1977
	Male	Female	
HB	105±3.0	102.0	107±10.9
Tail	75±2.6	70.0	77±3.9
HF	16.2±0.9	14.0	18.5
B.Wt.	32.0±8.1	32.0	18.0
ON	25.5±0.9	24.5	27.36±0.98
PF	6.5±0.4	6.0	5.92±0.26
Upper Molar	4.1±0.2	4.0	5.10±0.26

Marshall (loc. cit.) mentions in the key that *M. platythrix* possess 3+2 mammae but two specimens of this species from the Aravallis possess 4+2 mammae. These specimens were assigned to *M. platythrix* on the basis of shorter palatine foramina which is considered a more stable character for identification as compared to the number of mammary glands. Ellerman (1961) has also reported variations in numbers of mammae in *M. platythrix*.

TABLE 2
ALTITUDINAL DISTRIBUTION OF FIELD MICE IN THE
ARAVALLI RANGES

	<i>Mus phillipsi</i>	<i>Mus platythrix</i>	<i>Mus saxicola</i>	<i>Mus terricolor</i>
Abu Road and Anadra (150 m)	21.0	30.8	59.2	100
Chhepaberi (500 m)	36.8	—	3.7	—
Arna and Gomukh (1000-1100 m)	15.8	7.7	14.8	—
Mt. Abu (1500-1600 m)	26.3	61.5	22.2	—

Sadhu mouse *Mus saxicola sadhu*

Wroughton, 1911

Out of the four mice species collected, the sadhu mouse was the commonest (44.2 %). It occupied all the habitats except the runnels (Table 1) and occurred at all altitudes (Table 2). However, it was more abundant in the rocky habitat (62.9 %) and in flat scrublands (29.6 %) whether on foothills (18.5 %) or at higher elevations (11.1 %). Surprisingly, their occurrence was significantly more ($P < 0.001$) in rocky areas with sparse vegetation (*Euphorbia-Lantana* on eastern side of Abu hill and *Butea monosperma-Wrightia tinctoria-Aegle marmelos* on the western side) as compared to those with dense vegetation (*Butea monosperma*, *Anogeissus pendula/latifolia*, *Eugenia jambolana*, *Moringa concanensis*, *Aegle marmelos*, *Carissa carandas*). We studied in detail a few specific sites from which *M. s. sadhu* were trapped and it appears that the presence of soil deposits over rocks is its major shelter requirement. This was probably the reason it occurred in flat areas even at an altitude of 1500-1600 metres. In the scrublands, its burrows were located under herbacious cover. Small pebbles were seen arranged around two burrow openings. One male *M. s. sadhu* had arranged the faecal pellets of the blue bull, *Boselaphus tragocamelus* around three openings of its burrow system under a tree, *Prosopis spicigera* at Anadra. Two specimens were collected near the stone wall around crop fields at an altitude of 1600 m. One male *saxicola* was collected from a decaying log of *Butea monosperma*.

Maximum number (59 per cent) of this species was collected at the foothills (Table 2). One of the specimens (July-47) bears 5 + 2 pairs of mammae whereas other females possess the normal number 4 + 2 pairs.

Like *M. platythrix*, the specimens collected from the Aravalli region were smaller in size than those examined by Marshall (loc. cit.)

	Aravalli Collection		Marshall, 1977
	Male	Female	
HB	87.8±5.1	85.4±10.3	88.7±10.5
Tail	72.4±7.9	66.6±6.4	71.7±6.9
HF	17.0±0.5	16.0±0.7	18.16±1.17
B.Wt.	21.8±3.2	20.1±4.9	21.4±4.9
ON	24.1±1.1	23.0±1.3	24.77±0.93
PF	6.1±0.37	5.8±0.4	5.91±0.32
Upper Molar	4.4±0.38	4.0±0.3	4.36±0.23

Small spiny mouse *Mus terricolor*

Blyth, 1851

Only two specimens were collected from the grassland situated on plains at the foothills of Aravallis. One of them was captured from a burrow among the root system of *Cassia fistula* around 4 p.m. One of the females had perforate vagina so we considered it to be an adult. The specimens have been assigned to *M. terricolor* as they are too small to be *M. booduga* (reported earlier from Mt. Abu by Ryley 1913) or *M. dunni*.

The body measurements of Aravalli specimens are closely similar to *M. terricolor*. This species is reported for the first time from Rajasthan.

	Aravalli Collection		Marshall, 1977
	Male	Female	
HB	48.0	52.0	57.6±4.6
Tail	50.0	51.0	54.1±4.6
HF	12.0	13.0	14.28±0.54
B.Wt.	4.0	4.0	—
ON	17.0	17.0	17.64±0.58
PF	3.5	3.5	3.95±0.19
Upper Molar	3.0	3.0	3.04±0.17

DISCUSSION

Relative abundance: An intensive trapping of small mammals on the Abu hill of Aravalli range has indicated that, amongst various mice species, the sadhu mouse, *Mus saxicola* is by far the most abundant species followed by the fawn coloured spiny mouse, *Mus phillipsi* and the brown spiny mouse, *Mus platythrix*. *Mus terricolor* occurs on the foothills in very low number.

Habitat preference: Rocky habitat with sparse tree density but with good ground vegetation supports maximum population of mice (42.6%) and are more or less equally shared by *M. saxicola* and *M. phillipsi* (Table 1).

Rocks with dense tree density and scrubland on the foothills are the next in habitat preference of the mice. Loosely piled stone wall and runnels where three species except *M. terricolor* were collected, are again habitats with very low vegetation cover. This observation suggests that probably shelter to mice has a preference over the close vicinity of food, i.e. vegetation. These results also point out that excessive grazing and tree felling, thus denuding vegetation cover, may be one of the factors for creating a more preferred niche for the mice, resulting in increase of their population density. The detailed analysis of microhabitat from where mice were collected indicates that *M. saxicola* and *M. platythrix* prefer even rocky region with sufficient soil deposits which may be conducive to their burrowing habits. That is probably the reason that they were more prolific in flat deposits even at 1600 m altitude. *M. terricolor* was collected only from scrublands on the foothills.

Altitudinal distribution: It appears that the foothills are the most occupied habitat as 42.6 per cent mice were collected from this habitat (Table 2). Higher altitude (1500-1600 m) was the next in preference of mice and 31.1 per cent of the total mice were collected from these elevations. The mid altitudes were equally shared by them (13.1 % each, Table 2). *Mus saxicola* and *Mus terricolor* are more common at foothills. *Mus platythrix* occurred in higher numbers (61.5 %) at higher elevations

whereas *Mus phillipsi* occurred in almost equal numbers at all the elevations.

Reproductive Biology: Some information could be gathered on the reproductive aspects of mice from the field collection. Whereas the male and female ratio in the trapped animals was almost equal in *M. phillipsi*, *M.s. sadhu* and *M. terricolor*, it was highly biased in *M. platythrix* as out of 13 specimens collected only two were females. This bias may be due to a higher exploratory and wandering propensity of males due to which their trapping frequency may be higher as compared to that of females.

The capture of *M.s. sadhu* and *Mus phillipsi* was well distributed over the year. Surprisingly, however, none of the eight females of *phillipsi* was found to be pregnant. Out of 8 females of *Mus s. sadhu*, five, collected during April to September, were pregnant, average litter size being 5.4, range 2 to 9.

Taxonomy: Identification of mice in India has been problematic ever since Jerdon's and Blanford's days, probably due to overlapping body and cranial measurements of various species. However, a fairly large number of species were grouped by Wroughton (1918) under three genera: *Mus* (house mice), *Legadilla* (frontal supra-orbital ridge well pronounced) and *Leggada* (essentially jungle mice). Later these were merged into a single genus *Mus* by Ellerman (1961), lumping all the former species into half a dozen species. The common mice found in the sub-continent were identified through a simple key:

1. Tail longer than head and body *Mus musculus*
2. Tail smaller than head and body.
 - i) Size large, HB 90-110 mm, occipitonasal length over 25 mm *Mus platythrix*
 - ii) Size medium, HB 75-80 mm, occipitonasal length less than 23 mm . *Mus cervicolor*
 - iii) Size small, HB up to 75 mm, occipitonasal length less than 20 mm *Mus booduga*

Later Marshall (1977) examined specimens of mice in various museums and on the basis of morphometric characters, karyotypes and the species of lice found on mice body revised the Asian species of *Mus*. He brought about three major changes: restricted *Mus cervicolor* to Nepal, Myanmar,

Thailand, Laos, Vietnam; Sumatra and Jawa; re-erected the species *saxicola* (Elliot 1839) and regrouped the genus *Mus* into three sub-genera after rematching a large number of species described by Thomas (1921), Wroughton (1918) and other workers in the past:

Subgenus	Species
<i>Pyromys</i>	<i>shortridgei</i> , <i>saxicola</i> , <i>platythrix</i> , <i>phillipsi</i> , <i>fernandoni</i> .
<i>Coelomys</i>	<i>mayori</i> , <i>pahari</i> , <i>famulus</i> , <i>crociduroides</i> , <i>vulcani</i> .
<i>Mus</i>	<i>caroli</i> , <i>cervicolor</i> , <i>musculus</i> , <i>cooki</i> , <i>booduga</i> , <i>dunni</i> , <i>terricolor</i> .

In his revision, out of the six subspecies recognised by Ellerman (1961) under *Mus cervicolor*, Marshall (loc. cit.) shifted *fulvidiventris* under the species *Mus booduga* as its subspecies; *nagarum* and *palnica* to *Mus cooki*; *nitidulus* was synonymised as *M. cervicolor* and raised *M. phillipsi* to a specific rank. The subspecies *gurkha* and *sadhu* of *Mus platythrix* were shifted to *M. saxicola*. *Mus platythrix* was retained with *bahadur* as a synonym whereas the subspecies *shortridgei* of *Mus platythrix* was raised to a species rank. Marshall further based his keys for identification on mammary formula and length of palatine foramina besides several other characters. Detailed examination of mice collected in the Aravalli ranges reveal that the number of mammae is not a very firm character on which identification keys should be based. One of the females (Oct. 47 Mt. Abu) is over size for *saxicola* (HB = 102 mm, Body wt. 32 g, occipitonasal length 24.5 mm). Its palatine foramina length is more like *platythrix*, but has 4+2 mammae, like *saxicola*. If this specimen was a male (without mammae) we would have straight away put it under *M. platythrix*. Now also it has been assigned to species *platythrix*

disregarding the number of mammae and relying on the length of palatine foramina. However, the length of palatine foramina was found to be a firm feature to differentiate between *Mus* species.

We propose the following simple key to identify field mice found in the Aravalli ranges.

A. Tail shorter than head and body

- a. Head and body more than 62 mm
 1. Palatine foramina elongate, cutting deep between molars *Mus saxicola*
 2. Palatine foramina short, only touching the first molar
 - i) Size large, HB more than 95 mm, ON more than 24 mm *Mus platythrix*
 - ii) Size small, HB less than 90 mm, ON less than 23 mm *Mus phillipsi*
- b. Head and body less than 62 mm
 - Pigmy in size, HB up to 60 mm, ON about 17 mm *Mus terricolor*

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